58. A microelectronic device structure according to claim 40, wherein said top electrode layer comprises a composite electrode film including a noble metal and an oxygen-donor compound.

B3 cont'd

59. A microelectronic device structure according to claim 58, wherein the oxygen-donor compound is MnO.

60. A microelectronic device structure according to claim 58, wherein the oxygen-donor compound is CeO_2.

REMARKS

Amendment of Claims 40 and 49, and Addition of New Claims 51-60

Claims 40 and 49 have been amended above, and new claims 51-60 introduced, to place the application in condition for allowance.

Claim 40 is generic. All claims 41-60 depend directly or indirectly from claim 40.

Claim 40 has been amended herein to recite:

> **40. A microelectronic device structure including a top electrode layer on a top surface of a ferroelectric oxide or high ε oxide film material, said ferroelectric oxide or high ε oxide film material having a stoichiometric oxygen requirement, wherein a top surface region of the ferroelectric oxide or high ε oxide film material including said top surface and said ferroelectric oxide or high ε oxide film material within a depth of 25**

Angstroms measured from said top surface has an oxygen content equal to or in excess of said stoichiometric oxygen requirement of said ferroelectric oxide or high ε oxide film material.

(emphasis added)

Such amendment obviates and overcomes the rejection of claims 40-50 on §112 grounds (paragraphs 3 and 4 at pages 2-3 of the October 3, 2000 Office Action). The amendatory language in the claim relating to oxygen composition is supported by the disclosure in the application, e.g., at page 14, line 21 to page 15, line 9; and at page 16, lines 1-22.

Rejection of Claims on §103 Reference Grounds in the October 3, 2000 Office Action, and Traversal of Such Rejection

In the October 3, 2000 Office Action, claims 40-50 then pending in the application were rejected on reference grounds under 35 U.S.C. §103, including:

a rejection of claims 40-50 on §103(a) grounds as unpatentable over Aoyama et al.; and

a rejection of claims 40-50 on §103(a) grounds as unpatentable over Mihara et al.

These rejections of the claims are traversed and reconsideration of the patentability of the claims as amended/added herein is requested, in light of the following remarks.

Patentability Distinction of the Claims Over the Cited Art

Aoyama et al. disclose forming an electrode including at least one Group VIIA and/or Group VIII element on a semiconductor substrate, e.g., a dielectric such as BST, wherein "the content of

oxygen [in the electrode] being less than a stoichiometric quantity of oxygen that can exist in a form of an oxide of the element" (column 3, lines 8-10 of Aoyama et al.). The express concern of Aoyama et al. relating to the electrode is to prevent the electrode from being silicified (column 2, lines 56-57). The disclosed electrode is "formed of a conductive material containing extremely small quantities of oxygen" (column 5, line 15), "more preferably 0.004 to 5 atom %, most preferably 0.1 to 5 atom %" (column 5, lines 33-34), with the patent cautioning that "if the content of oxygen is too much, a very large compressive stress may be generated in the step of film deposition so that the film formed may be peeled off' (column 5, lines 36-39).

Accordingly, Aoyama et al. teaches to incorporate and localize a tiny amount of oxygen in the metal electrode so that the electrode is passivated against reaction with silicon ("silicification"). Aoyama et al. is focused on the electrode element of the semiconductor device structure in respect of oxygen content, and such reference is devoid of any teaching or suggestion of "bulking up" or stoichiometrically enhancing oxygen in the dielectric film of the disclosed capacitor.

Against such background of the actual teachings of Aoyama et al., there is no derivative basis in such reference for the applicants' claimed invention as broadly claimed in claim 41, from which all other pending claims 42-60 directly or indirectly depend. Further, the Examiner's contention (page 4 of the October 3, 2000 Office Action) that "oxygen concentration and its profile in the ferroelectric film surface are well recognized parameters of importance subject to routine experimentation and optimization" clash with the fact that Aoyama et al.'s focus is on the metal electrode, and not on the dielectric material.

Accordingly, claims 41-60 are submitted to be fully patentably distinguished over Aoyama et al.

Concerning the Mihara et al. reference, such patent has been cited as describing a microelectronic device structure including a top electrode layer on a ferroelectric film "with a conductive metal oxide (Ru Oxide) for the purpose of compensating for a potential oxygen deficiency region in the ferroelectric surface layer" (page 5, October 3, 2000 Office Action).

Such disclosure of Mihara et al. in fact is a teaching away from the applicants' broadly claimed invention of:

> **40. A microelectronic device structure including a top electrode layer on a top surface of a ferroelectric oxide or high ε oxide film material, said ferroelectric oxide or high ε oxide film material having a stoichiometric oxygen requirement, wherein a top surface region of the ferroelectric oxide or high ε oxide film material including said top surface and said ferroelectric oxide or high ε oxide film material within a depth of 25 Angstroms measured from said top surface has an oxygen content equal to or in excess of said stoichiometric oxygen requirement of said ferroelectric oxide or high ε oxide film material.**

since Mihara et al. teaches the use of a compensatory RuO layer to remedy oxygen deficiency in the ferroelectric surface layer. There is no teaching or suggestion in Mihara et al. of the ferroelectric oxide having "an oxygen content equal to or in excess of said stoichiometric oxygen requirement of said ferroelectric oxide or high ε oxide film material" - if Mihara et al.'s ferroelectric material had a bulked up ferroelectric material oxygen content $\geq$ the stoichiometric oxygen requirement of such material, *there would be no reason to "compensate" in the manner*

that Mihara et al. has taught! If, as contended by the Examiner, it is obvious to make the ferroelectric material of Mihara et al. "stoichiometrically complete in oxygen concentration" (page 6, October 3, 2000 Office Action), why did Mihara adopt a contrary approach of attempting by an exterior film to compensate for the oxygen deficiency of the ferroelectric material? The only answer is that there is no answer - no rationale or basis in Mihara et al. for the applicants' broadly claimed invention of claim 41, or of the subject matter of claims 42-60 dependent thereunder.

For all of the foregoing reasons, it is submitted that claims 41-60 as herein amended/added are patentably distinguished over Mihara et al.

Fee Payable for Added Claims 51-60

The addition herein of claims 51-60 entails no increase in the number of claims beyond the number for which payment previously was made in this application. Accordingly, no additional fee is submitted to be due.

If nonetheless it is determined that any additional fee or charge is properly payable, the same hereby is authorized to be charged to Deposit Account No. 08-3284 of Intellectual Property/Technology Law.

CONCLUSION

Claims 40-60 are patentably distinguished over the art and in form and condition for allowance. Favorable action therefore is requested.

Respectfully submitted,

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